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SPECIAL ARTICLES

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Diphtheria Toxoid as an Immunizing Agent*

By J. G. FITZGERALD, M.D., LL.D.

Director, School of Hygiene and Connaught Laboratories, University of Toronto

BEFORE discussing specifically the use of diphtheria toxoid as a means whereby prolonged immunity to diphtheria may be secured, it is proposed to discuss very briefly certain aspects of the question of antigens in general. Antigens are those substances which upon injection into the human or animal body stimulate antibody formation. Their precise chemical nature is both obscure and a matter at present in dispute. Nearly all of those who have investigated antigens are agreed that they are:—

1. Large colloidal molecules usually proteins and "foreign" to the animal species in which they are to stimulate antibody production in other words heterologous proteins.
2. They must be soluble and must as a rule be "complete" proteins. Incomplete proteins, deficient in aromatic amino acids such as gelatin, are not antigenic. On the other hand incomplete proteins, such as zein, lacking the amino acids, lysine and tryptophane, but possessing tyrosine, are antigenic.
3. Proteins coagulated irreversibly by heat or alcohol are not usually antigenic. (Casein, however, if heated but still soluble, is antigenic).
4. Proteins, if converted into soluble acid meta-proteins are antigenic. If converted into alkaline meta-proteins, they are nonantigenic.
5. After complete hydrolysis, proteins are no longer antigenic even though all the products of hydrolysis are employed.
6. Carbohydrates of the polysaccharide type are, alone, incapable of stimulating antibody formation (with the possible exception of a glucoside extracted from *Amanita phalloides* and studied by Ford) but combined with protein they confer a high degree of specificity upon the antigen of which they constitute a part.
7. The antigen in solution must penetrate beyond the epithelial surface before it can stimulate antibody formation.

*Read at the twelfth annual meeting of the American College of Physicians, Cleveland, February 21, 1927.

There is a very considerable difference of opinion as to whether lipoids may act as antigens. Wells¹ (1924) in discussing the question concludes: "In view of all the foregoing contradictions and difficulties it seems justifiable to say at this time that the capacity of fats and lipoids to serve as true antigens, capable of inciting the production of specific antibodies when injected into animals, has not yet been established." To this view I subscribe. On the other hand, Fairley² (1927) has just brought forward evidence which he believes establishes the fact that "alcohol-soluble cercarial extracts function as true antigens." Since there is thus far no reason to believe that the antigens which have been employed to stimulate diphtheria antitoxin production are dependent upon their lipid content either for their antigenic capacity or their specificity, the question need not be further considered here.

That diphtheria bacilli elaborate a potent poison when grown in artificial media was first shown by Roux and Yersin.³ Fraenkel⁴ and von Behring⁵ in 1890 actively immunized guinea pigs against this poison or toxin. These contributions constitute the experimental basis for vaccination against diphtheria as well as for the production of diphtheria antitoxin. Many years elapsed, however, before it was proposed that human beings might be actively immunized or vaccinated against diphtheria, using diphtheria toxin for the purpose. It appears the Dziergowsky⁶ was the first to attempt this and he carried out experiments on himself. He repeatedly injected himself with increasing doses of diluted toxin and stimulated antitoxin production. There were no evident ill-effects in consequence. For obvious reasons, unmodified diphtheria toxin was not introduced as an immunizing agent suitable for human use.

In 1907, Theobald Smith suggested that toxin-antitoxin mixtures might be employed for vaccination against diphtheria. The proposal was based upon the results obtained employing exactly neutral mixtures of diphtheria toxin and antitoxin in guinea pigs. Von Behring in 1913 first introduced toxin-antitoxin mixtures for human use. Since 1913, Park and his collaborators in New York have, by their combined clinical and laboratory studies and through large scale employment of such mixtures, led in the campaign for the control of diphtheria through specific prevention.

In the meantime the search for a more satisfactory immunizing or vaccinating substance had been continued. In 1898, Salkowski and in 1904, Loewenstein described the action of formalin on soluble toxins. In 1921, Glenny and Sudmerson and in 1923, Glenny, Allen and Hopkins⁷ proposed that formalinized toxin be used in human immunization against diphtheria. This toxin to which the name toxoid was given was slightly toxic. Finally in 1923 and 1924, Ramon⁸ of the Pasteur Institute

in Paris introduced the term anatoxine to describe diphtheria toxin which as a result of the action of formalin and heat has completely lost its toxicity but has retained its flocculating power and its antigenic action. Too great credit cannot be given Ramon in recognition of the importance of his observations. He also introduced a flocculation test, the value of which is very considerable. Ramon insisted at the outset, and has always maintained since, that anatoxine differed from any modified toxin previously described in being atoxic, while retaining antigenic and flocculating properties. This opinion I and my colleagues in the Connaught Laboratories also hold.

Just recently (January, 1927) Ramon⁹ and his collaborators have shown that tetanus anatoxine can be prepared by growing tetanus bacilli in a medium containing beef bile. In a preliminary communication dealing with this aspect of the subject Ramon and his co-workers state "the tetanus bacillus can be grown satisfactorily in bile bouillon; if sufficient bile is added it is possible to obtain some sort of spontaneous transformation of the toxin into a product which possesses the fundamental properties of anatoxine, namely: is innocuous, has flocculating power, antigenic value and stability." (*Le Bacille tétanique cultive parfaitement bien en bouillon bilié; en ajoutant suffisamment de bile, il est possible d'obtenir la transformation en quelque sorte spontanée de la toxine en un produit que possède les propriétés fondamentales—innocuité, pouvoir flocculant et valeur antigène, stabilité—des anatoxines.*) As to whether tetanus toxoid thus prepared could be employed in human vaccination remains to be ascertained.

The methods employed in the Connaught Laboratories for the production and standardization of toxoid have recently been described in detail by my colleague P. J. Moloney.¹⁰ In an earlier communication, Moloney and Weld¹¹ dealt at length with some of the more theoretical questions with which Ramon dealt in his series of publications. It was suggested that the flocculation test might be employed as a satisfactory substitute for the Ehrlich procedure in the assay of antitoxic values. Moloney and Weld observe on this point: "The Ramon test cannot be used as a measure of antitoxin as defined in Ehrlich units. It may be used as a rough guide to animal testing." Since, at the present time, the consensus of opinion favours the view that toxin neutralizing power is a measure of therapeutic efficacy and presumably also of protective power, Ramon's in-vitro test cannot be substituted for the in-vivo method of Ehrlich.

Moloney and Weld, too, do not believe on the basis of their work that the indicating tube in the Ramon test always represents a balanced mixture or that flocculating power is a measure of antigenic value. They do agree, however, that "the flocculation test can be used to determine

whether or not a toxoid possesses any immunizing value and that it is of value as a guide in the preparation of toxoids."

It may be desirable at this point to refer to certain disadvantages which appear to be inherent in the various toxin-antitoxin mixtures heretofore chiefly employed in the prevention of diphtheria. There have been at least three different mixtures fairly generally used in the United States and, to a limited extent, in Canada. These are the so-called "3L₊"; "1L₊" and "1/10L₊" mixtures. In the preparation of all of these the essential criterion of their suitability for the production of immunity in adults or children was a specified toxicity, that is, their capacity to induce paralyses or cause death in guinea pigs when injected in certain quantities. Their antitoxin producing capacity, while sometimes determined, was not ascertained as a routine procedure. In other words, the value of various preparations was not based upon preliminary laboratory studies of the antigenic value of each and every toxin-antitoxin mixture employed. The results of the widespread use of these mixtures in schools, institutions, etc., indicated, however, that thousands of persons became Schick negative and presumably immune after receiving 2 or 3 doses. Some years ago (1923) Glenny, Allen and Hopkins⁷ introduced a simple method of testing the antigenic value of toxin-antitoxin mixtures, which has proven very useful in ascertaining antigenic values or what Glenny has termed the immunity index. The method consists in injecting guinea pigs with a dose of the preparation being investigated, allowing the animal to rest for several weeks (3 or 4) and then doing Schick tests on these animals at weekly intervals. Moloney has modified this procedure and in the Connaught Laboratories "the toxin undergoing modification is tested for toxicity at weekly intervals. These preliminary tests are carried out by injecting intradermally 0.1 c.c. of the undiluted toxin and 0.1 c.c. of a 1/5 and 1/25 dilution into the skin of a guinea pig. Detoxification is considered complete when the 1/5 and 1/25 dilutions show a reaction of 5 mm. or less and the undiluted material a reaction of 12 mm. or less."

"The potency of the product is determined by injecting subcutaneously 0.5 c.c. amounts into each of 5 guinea pigs (300 to 320 grms. in weight). At the end of a month these animals are Schick tested and in the subsequent week they are again Schick tested. Immediately following the reading of the second Schick test 5 M.L.D.'s of diphtheria toxin are injected into each animal. At least 4 of these animals must survive. The results of the Schick tests give preliminary evidence regarding the immunizing value of the toxoid." Thus precise information is available indicating that the preparation of toxoid readily stimulates antitoxin production in experimental animals and also is quite innocuous before it is employed in the vaccination of persons against diphtheria. This

appears to us to mark a very definite advance in standardization and control.

In the preparation of toxoid in the Connaught Laboratories, a toxin containing not less than 400 M.L.D's per c.c. is used. Formalin is added to a concentration of 0.3 per cent. The mixture is heated at 37°C. for from 1 to 4 weeks until detoxification is complete. Moloney has shown that the rate of detoxification is much more rapid at a pH of 8.5 than at a pH of 7.0. In a general way it may be said that the more alkaline the medium, the more rapid will be the rate of detoxification. The essential values then with which we are concerned are: (1) antigenic power, (2) absence of toxicity, (3) flocculating power, and (4) stability. It is unnecessary to ascertain L_+ or L_0 values and the elaborate time-consuming and expensive procedures inherent in testing toxin-antitoxin mixtures are eliminated. It should be noted that the antitoxin producing capacity of any preparation of toxoid is provisionally as well as finally noted, the former on the basis of toxin-neutralizing power in the skin and the latter on the basis of protection against five lethal doses of toxin. Furthermore these methods are simple, inexpensive, require but little time and in the hands of my colleagues have been easy of interpretation, which is a matter of prime importance in any method of assay of a biological nature. Experience during the past two years in our laboratories has convinced us that in the great majority of instances successive preparations of toxoid have a high degree of uniformity, if certain elementary precautions are taken to ensure constant conditions in respect of those factors of which we have some knowledge, such as original toxicity, concentration of formalin, absence of phenol, period of heating, etc.

Another aspect of the question of antigens in general and of diphtheria toxoid in particular, which has very considerable interest, is that relating to purification or concentration. Diphtheria toxoid essentially consists of water, extractives of meat (protein and protein split-products, inorganic salts, etc.), diphtheria bacillary protein and the specific poison or toxin. How much of this admixture is extraneous and how much is essentially antigenic? Watson and Wallace,¹² Glenny, Hopkins and Pope,¹³ Moloney and Weld¹⁴ and others have endeavoured to answer this question. The Watson and Wallace procedure for purification consisted in chilling toxoid to a temperature of 5° C. and adding glacial acetic acid sufficient in amount to give a heavy precipitate (about 2.5 per cent). When coagulation was complete the material was centrifugalized and the precipitate which contained the antigen was suspended in cooled distilled water and solution was brought about by the addition of cold sodium hydroxide. The pH of this was not allowed to become more alkaline than 8.4. The purified and concentrated material was suitably

diluted with physiological salt solution. Moloney and Weld in their modification substituted sodium bicarbonate solution for sodium hydroxide to dissolve the precipitate. This was advantageous because there was thus no danger of the mixture becoming too alkaline since the pH of concentrated sodium bicarbonate solution is approximately 8.2. A further step in purification was developed by Moloney who suggested the addition of alcohol up to 85 per cent concentration to the sodium bicarbonate solution. The antigen is in the dissolved precipitate. The degree of purification will be understood by reference to the following data on the nitrogen content—

100 c.c. of original unpurified toxoid contained 260 milligrams of nitrogen.

100 c.c. of toxoid purified by the Watson and Wallace procedure contained 0.25 milligrams of nitrogen.

100 c.c. of toxoid purified by the Moloney method contained 0.20 milligrams of nitrogen.

It has been observed, however, that these purified toxoids are very much less stable than the unconcentrated material. Furthermore, O'Brien observed that the purified Watson and Wallace material still gave rise to reactions in sensitive individuals and Moloney noted that his purified toxoid also occasioned reactions in such persons. It would appear, then, that the injection of material containing even very minute quantities of nitrogen produced local or general reactions in those who have what is perhaps a non-specific sensitization to foreign proteins. Such reactions occurred especially in older children and adults. The elimination of the protein moiety in the antigen (which may be described as the "reacting" substance) rendered the purified material non-antigenic. It must be admitted that the search for an ideal immunizing agent against diphtheria may have to be prosecuted for a very much longer time in the light of these observations.

It having been established that toxoid quickly stimulated the appearance of antitoxin in rabbits and guinea pigs, careful quantitative assays of the response in persons whose normal antitoxin content was known were undertaken. We are still greatly in need of further information as to how so-called natural immunity to diphtheria is acquired. It seems likely, however, that many persons develop their protection as a result of contact with those harboring diphtheria bacilli, from whom they receive, in a haphazard fashion, what Dudley has described as a sub-infective dose of the micro-organisms. Dudley has shown too that in a so-called diphtherial environment there is, after a short period, a definite increase in the number of immune individuals and a corresponding reduction in the number of susceptibles. This is one of the few observ-

ations bearing upon the mechanism of acquired diphtheria immunity in man which seems to be significant. It has also been suggested by several investigators that so-called "pseudo-positive" Schick reactors (that is persons sensitive to diphtheria bacillary or other protein in the toxoid) may possibly respond more readily to injections of diphtheria antigen than do non-sensitive persons.

Another question of fundamental importance is this: are there fluctuations from time to time in the status of individuals in respect of their immunity or susceptibility to diphtheria? I have had repeated careful quantitative assays made of the diphtheria antitoxin of the blood of myself and of a small group of my associates during the past three years. There is no evidence as yet to show that either those with a considerable quantity or those with practically no demonstrable natural antitoxin show variation in content from year to year, under what might be described as ordinary conditions of urban existence. Those comprising this group had not been actively immunized to diphtheria. Until it is possible to follow closely a group of children from infancy onward to the time when those among them who were originally susceptible acquire immunity it seems improbable that any further information upon this question will be obtained. Such a group if kept under observation in an institution, where repeated assays of antitoxin could be made and careful examination undertaken at intervals to ascertain whether diphtheria bacilli were present at any time on the nasal or pharyngeal mucosa, might easily furnish the information which we lack at present.

Our early studies of the action of toxoid in stimulating antitoxin production in human beings were made upon a small group of persons in the Connaught Laboratories. Both Schick tests and quantitative assays of the antitoxic response were made and it was found that very pronounced increases in content quickly followed the administration of toxoid. Individuals who were Schick positive and were given doses of 0.25 c.c. and 0.5 c.c. of toxoid respectively developed from 0.1 to 1 unit of antitoxin per c.c. of blood within two and a half months. One of my colleagues showed an increase in antitoxin content from less than 0.01 to 10 units per c.c. of blood within 3 months. No one in the first group given toxoid by us failed to develop immunity. On the basis of these preliminary results, arrangements were made for a more extended trial of toxoid among persons living in institutions who could be investigated some time after they had received the material so that its capacity to induce an immunity as well as the persistence (at least for a time) of this immunity could be determined. Again promising results were obtained and in September, 1925, the distribution of diphtheria toxin-antitoxin was discontinued and toxoid was substituted. In the autumn of 1925 in the Essex Border Municipalities, (Windsor, Walkerville, Riverside,

Ford City, Sandwich and Ojibway), about 7,000 pre-school and school-age children were given 2 doses of toxoid by the Local Board of Health and about 2,000 other children were immunized by physicians in private practice, making 9,000 in all who were given 2 doses; in addition 1,600 others received only 1 dose. During October, November and December, 1926, in the same communities, 3,000 additional children were given 2 injections of toxoid. Dr. Adams, the Medical Officer of Health of the Essex Border Municipalities, (to whom I am indebted for the above and certain additional data) has intimated that perhaps 2 to 3 per cent of the children had fairly marked reactions and about 25 per cent some slight local reaction.

Toxoid was administered to many thousands of school children in the Province of Saskatchewan during the year 1925-26, under the direction of Dr. M. M. Seymour, Deputy Minister of Health for Saskatchewan. During the period, July 1, 1926, to February 1, 1927, between 100,000 and 120,000 persons, resident in the nine Canadian provinces have received diphtheria toxoid.

Two or three other points must be referred to briefly. Attention has already been called to the fact that certain individuals develop local or general reactions after receiving toxoid. Zoeller and my associate P. J. Moloney have shown that these persons may be detected by means of a very simple procedure. Dr. Moloney's method of testing for marked toxoid reactors is as follows: "Inject intradermally 0.1 c.c. of a 1/20 dilution of toxoid. If a reaction at the site of injection develops within 3 days which measures more than one-half an inch in diameter it is recommended that toxoid be not given." It has been found by experience that very few children under six years of age have severe reactions after receiving toxoid and that marked reactions in children under 8 are quite uncommon. Therefore it is strongly recommended that children be vaccinated in early childhood, preferably in the first six years of life for the reasons that they are then in the age period when they most need it (when diphtheria morbidity and mortality are highest) and when reactions following vaccination with toxoid are least likely to occur. Older children or adults may also be given toxoid if they are not reactors and if it is deemed necessary. The doses of toxoid at present recommended by us, are 0.5 and 1.0 c.c., respectively, given at an interval of one month. This suggestion as to dosage is based upon preliminary experimental data. If later results indicate that more than 2 doses are desirable, a change to 3 doses will be made.

We have evidence which shows that more than 70 per cent of those given 2 doses of toxoid have developed immunity in less than 3 months. How durable this will prove to be we do not know as yet. There is no reason why active immunity resulting from the administration of toxoid

should be more transient than that which results from the injection of unmodified toxin or of toxin-antitoxin mixtures. In any case, the persistence or disappearance of protection conferred by toxoid can be readily ascertained by means of the Schick test or by quantitative assay of antitoxin content.

In conclusion, may I repeat that diphtheria toxoid appears to us to be preferable to toxin-antitoxin as an immunizing agent. Equally important, however, in our judgment is the desirability of encouraging vaccination against diphtheria during the first 6 or 8 years of life rather than later.

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Antenatal Clinics in England and France

By RUGGLES GEORGE, B.A., M.B., D.P.H.

THE man who said "Catch 'em young, treat 'em rough and tell 'em nothing" was giving advice on the management of wives. Had his advice been given for the management of Antenatal Clinics he might have performed a version on the latter part of the statement and thereby altered the formula to "Catch 'em young, treat 'em good and learn 'em something".

These are three sound principles for the management of Antenatal Clinics, although the application of these principles varies in different countries. If we consider the comparative anatomy and physiology of the Antenatal Clinics as developed in different countries, some light may be shed on our own problem in Canada and, with this end in view, it may be of interest to consider the system in vogue in France and in England.

The Antenatal Clinic in France¹ exists to protect the expectant mother and to reduce infant mortality. This function includes supervision of the pregnancy, detection of complications, recognition of the presentation and any necessary social service work. Care should be given both before and after birth and medical care should be supplemented by necessary social service. Every Antenatal Clinic should be linked with a centre for the treatment of syphilis. Such a Centre may be described euphemistically as for the treatment of "hereditary diseases" and should treat not only active syphilis in the pregnant but also syphilis in non-pregnant women of child-bearing age and in fathers. The doctor in charge of an antenatal clinic should be ever mindful of congenital syphilis and he should encourage patients to seek antenatal care early in pregnancy in order to diminish the risk of syphilitic abortion.

The best location for an Antenatal Clinic is in a health Centre used at other times as a child welfare centre and for the treatment of Venereal Disease. This arrangement saves personnel, space, equipment and expense. It also accustoms mothers to use the Clinic as a true Health Centre. As Coulevaire puts it—"The Antenatal Clinic is part and parcel of health machinery for mother and child".

The arrangement of the Clinic should include:

(a) A waiting-room subdivided to prevent danger of infection among the patients.

(Read before a Combined Meeting of the Section of Obstetrics & Gynaecology with the Section of Preventive Medicine & Hygiene, Academy of Medicine, Toronto, on March 3rd, 1927.)

(b) An examining-room of adequate size with a gynaecological table, a couch, desks for the doctor and nurse, weight scales for adults and infants and apparatus for the analysis of urine and the estimation of blood pressure.

(c) A small private room off the examining-room in which the doctor may speak to a particular mother.

(d) A lavatory and dressing room for patients.

The Clinic should be supplied with water and gas or electricity.

Clinics should be held several times a week and at hours convenient to women employed in industry. Patients should be encouraged to come early in pregnancy.

To avoid gossip and embarrassment, the Venereal Disease Clinic should be held at the same place as the Antenatal Clinic. Treatment should be intensive and include the husbands of married patients.

A public health nurse is indispensable to an Antenatal Clinic. In her home visits she encourages women to attend the clinics, gives helpful advice on personal and home hygiene, talks over the question of layette and gives sound preliminary advice on the importance of breast feeding. At the Clinic, the public health nurse assists the doctor, reports the results of her home visits, fills in records and examines specimens of urine. Either the public health nurse or a social service worker obtains aid when required from suitable public or private philanthropies.

Practising physicians and local medical organizations should be impressed with the fact that the Antenatal Clinic is not in competition with private practice. The co-operation of the local medical profession will be promoted by the adoption of the following policy:

(a) The local medical Association should either nominate the Clinic Medical Officer or approve his appointment, or, better still, assume the professional direction of the Clinic.

(b) The Clinic should care for no patient who is not a genuine indigent.

(c) If the patient has a family physician, the Clinic should furnish complete reports of clinical and laboratory examinations, of diagnosis and treatment required.

(d) If the non-indigent patient has no family doctor, she must indicate a practising physician to whom reports will be sent.

(e) The Clinic should do bacteriology, serology and radiology for physicians upon patients referred by family physicians to the Clinic for these special reports.

(f) The visiting nurse should link up the patient and the physician. Her duty is preventive and should not detract from or interfere with private medical practice.

The system in England is thus outlined in a Memorandum² issued by the British Ministry of Health.

"A Centre may be established and maintained either by a local authority or by a voluntary body; many of those maintained by voluntary bodies receive financial assistance from the local authority; this tends to secure close co-operation between the local authority and the voluntary body, which is essential to the complete success of a general scheme for Maternity and Child Welfare. Whether the institution is maintained by the local authority or by a voluntary body, it is eminently desirable that it should have a Managing Committee containing voluntary workers and including working women. Their assistance, both on the Committee and in the practical work of the institution, creates an atmosphere of human sympathy and friendship which is eminently desirable. The value of disinterested work of this kind is immeasurable. But voluntary helpers will only be of use if they are competent, can attend regularly, and have definite duties allotted to them. Such work as the keeping of records, preparing babies for weighing, showing model garments and giving simple instructions as to their making, may properly be undertaken by voluntary workers. They should not be entrusted with more responsible work unless they have undergone a definite period of training at a Centre or elsewhere.

"The main function of the Maternity and Antenatal Centre is to advise expectant mothers in matters relating to their health, primarily in regard to conditions directly associated with pregnancy, but also as to general ailments which indirectly affect their physical welfare. The work of the Centre is thus largely educational and preventive. The women may come of their own accord, may be sent by doctors, midwives, or health visitors, or may be referred from an Infant Welfare Centre or other Institution.

"No internal examination should be conducted unless it is necessary in the interests of the patient; in every case the nature of the examination and the reasons for making it should be explained to the patient, her consent obtained, and the resulting information made available to the midwife. This rule should be observed with special care if the woman has been sent for advice in regard to some general ailment such as dyspepsia or carious teeth.

"The Centre should be under medical supervision. It is important to secure a Medical Officer who has had particular experience of obstetrics and gynaecology and, if possible, of their application in consulting or general practice. Whenever practicable the Medical Officer attached to a Maternity Centre should be a woman. If the Medical Officer is not specially qualified for this work, arrangements should be made for referring cases to a specialist whenever this is advisable. The Medical

Officer should be assisted by at least one competent nurse-midwife, or by the health visitor of the district, who, if possessing the qualifications of nurse and midwife, may properly act as Superintendent of the Centre. As compared with an Infant Welfare Centre, there is much less opportunity for voluntary help at a Maternity Centre, unless it is rendered by trained women or is limited to social enquiries and assistance.

"Premises should comprise suitable rooms for waiting, dressing and consultations (with couch for examination purposes). There should also be adequate lavatory and sanitary accommodation. Facilities for the testing of urine should in all cases be provided.

"The scope of the work should include:

"(a) Consultations, which should be conducted by the medical officer. A note should be taken of the previous general and obstetric history; a careful external examination should be made and measurements taken, followed when necessary by an internal examination. The urine should always be tested, and an examination made of heart, lungs, etc., whenever indicated. Incidental treatment, *e.g.*, for constipation, may be prescribed, but if definite disease or deformity exists the patient should be referred to a private doctor or to a Maternity or General Hospital. Patients should be encouraged to attend regularly up to the time of their confinements, and specimens of their urine should be obtained as often as may be necessary. They should also be able to secure treatment for minor ailments at the Centre. Simple drugs, bandages for varicose veins and so forth, may be sold at cost price or less in necessitous cases. After the confinement attendance for advice in regard to ailments arising from pregnancy or lactation should also be encouraged.

"(b) Home Visiting is a valuable adjunct which should be carried out by a health visitor or nurse-midwife.

"(c) Educational Classes in the hygiene of pregnancy, mothercraft, making garments for the baby, etc., are needed, especially by young mothers; they may often be provided conveniently in connection with the education given at the Infant Welfare Centre.

"(d) Dinners or milk for expectant and nursing mothers may be provided through the Maternity Centre. One of the most efficient and important means of securing healthy pregnancy is by ensuring adequate nutrition. The heavy claims made by the child in utero on the physique of the mother are not always appreciated, nor is the need of the mother for additional nourishment during this period. The Ministry desire to emphasize the value of milk and of suitable meals taken under conditions which enable the mother herself to derive the full benefit from them during pregnancy and lactation.

"(e) Dental treatment for expectant and nursing mothers should be included in the scope of the Centre whenever possible, as there is reason to believe that carious and septic teeth exercise a specially deleterious effect on health during pregnancy and lactation.

"(f) Patients with venereal disease should be treated at a Venereal Disease Clinic and those with a complication of pregnancy referred to a Maternity Hospital."

So much for what they wish to do, now how does it work out? Perhaps this may be judged best from a report³ published in 1925 giving the results of an enquiry made of over two thousand persons engaged in this work in England and Wales. Even to summarize this report would take too long but here are a few of the more noteworthy facts elicited by the enquiry:

(a) Specialists in obstetrics are in charge of 61% of the Clinics.
(b) Internal examinations are made in all cases at 18% of Clinics and when considered advisable at 69% of Clinics.

(c) Routine forms for record are used by 43% of Clinics.

(d) A thorough medical examination of each expectant mother, in addition to the special obstetrical examination, is made by 60% of Clinics.

(e) Home visits by health visitors are a routine procedure in 77% of Clinics.

(f) Instructional classes for expectant mothers are held by 40% of Clinics.

(g) Only 8% of Clinics hold exhibits of clothing and supplies for Infants and Mothers. This is rather disappointing. There are so many ways of improving the health of the expectant mother through an increase in her comfort that it seems a highly desirable thing to have on view such articles of clothing as will conduce to this end. There is no doubt that an exhibit of this kind, which makes a direct visual appeal to mothers, stimulates them to imitate and when once they have found how comfortable pregnancy can be, become the best means for spreading useful information.

(h) The average number of patients that can be handled successfully at one session by one doctor is from ten to fifteen. It is not good for expectant mothers to be hustled. They should feel that they have time to detail their worries for everything has a bearing on the case. They should be allowed the luxury of feeling that the doctor's time is at their disposal for only in this way can they receive the full benefit the Clinic should offer.

The rapid realization of the importance and benefit of Antenatal Clinics is seen in the fact that in 1918 there were 122 Centres in England and Wales and in 1925, 641 Centres, in seven years a fivefold increase.

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¹Personal Communication from Director of Health Division, League of Red Cross Societies, 2, Avenue Velasquez, Paris (VIIIe), France.

²Memorandum in regard to Maternity and Infant Welfare Centres. H. M. Stationery Office, London, 1919. Price 2d. net.

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The Economics of World Health

By LOUIS I. DUBLIN, PH.D.,

Statistician Metropolitan Life Insurance Company, New York.

ONE shudders a bit at the very thought of an economic evaluation of life. How much is a mother, a wife, or a child worth? The very words leave one cold; for life in its full implications is not commensurable with money. Life and health have a much higher and deeper value for us than money; in fact, they give value to everything else. Life and health are ends in themselves. They do not require any further justification for their conservation. If, therefore, in this paper I appear to evaluate life and health in terms of dollars and cents, it is not because that is the only way of evaluating them. I am simply attempting to place a money value on one very narrow aspect of life namely, its actual cost to maintain, and its productive value in terms of dollars and cents. In this sense alone, life and health have economic value, and their evaluation on this basis should render a real service to those who are engaged in their protection.

It is a habit with us Americans to emphasize the importance of our national wealth but always in terms of real property, machinery, and of manufactured products. We quite forget that human life exceeds in value all such goods by a very large margin. Human capital is the nation's greatest asset. No wonder that we are wasteful of our human resources. We appreciate the value of life and health only when we lose them. It is when earnings cease through illness, and expenses mount that we recognize the value of life and health. It is when the breadwinner of a family is removed through accident or disease and the mother and young children must become self-supporting that, first the dependents, and later the community, realize the large capital value which has been lost. But, even if such circumstances bring us the realization of the value of the individual, we give ordinarily little thought to the value of our living assets as a whole. We express in a hundred ways this indifference and lack of understanding. We are free with money as no other people, but are niggardly indeed with expenditures that are intended to conserve life and health. We do not realize how great are the immediate possibilities for saving our human resources and how profitable an investment life conservation can be.

To lay a foundation for the proper understanding of the economics

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of life and health it is necessary first to determine some items in the cost of human life and to discover also the net value of the earnings of average individuals. For a number of years my associates and I have been engaged in making a series of computations along these lines. Our first task was to calculate what it costs to bring up a child in a typical American community to age 18 when he may become self-supporting. Our computations were for the great body of wage-earning families of the country whose total family resources are about \$2,500 a year. Under present conditions the cost of rearing a child in such families to the age of self-support, including all the usual items of food, shelter, clothing, education, etc. etc., is \$7,238. Including interest on the capital and making due allowance for the cost of those who do not survive age 18, the amount is increased to a little more than \$10,000. This amount does not include one very important item, namely, the money value of the mother's care. We were compelled to limit ourselves to the family's money income, but we recognize that the working mother makes a real contribution to the total income of the family; for if wages were to be paid commensurate with the mother's value in the bringing up of children, the sum would be considerable and would add materially to the \$10,000 actually spent by the family in raising a child to self-support. Our figure is, therefore, a minimum and will serve to keep our other calculations conservative.

The cost of bringing up a child may be looked upon as capital invested which will produce future returns. The process of raising children may be compared with winding up a piece of machinery which is later expected to do useful work. From an economic standpoint the bringing up of children is an investment, in fact, a very profitable investment not so much for the immediate family as for the community as a whole. The great majority of adults produce a good deal more than they consume and add to the capital value of the communities in which they live. If this were not so, the total national wealth would not increase as rapidly as it has during the last century. Our second effort accordingly was to compute the value of a man as a wage earner, that is, to determine the returns from the investment in human capital. Our computation proceeded with the same group of people, namely, those who were in the \$2,500 income class. We did not include the money equivalent of the wife's services. But, disregarding this item, we found that the present worth at age 18 of his future earnings was calculated well in excess of \$41,000, and the present worth of his future expenditures less than \$13,000. The present worth at age 18 of the net future earnings of a man in this economic class was accordingly close to \$29,000. The maximum value of a man in this income class is reached at age 25, when the present worth of his net future earnings is more than \$32,000. With advancing

age, the present worth of net future earnings declines. At 50, it is \$17,510; at 60, about \$8,500. After age 70, the present worth of net future earnings is negative because earnings cease and the cost of maintenance continues. An astonishing item in our calculations is the high economic value of a child at birth. We found the sum to be \$9,333. This is the amount which it would be necessary to put at interest at three and a half per cent, in order to bring up the child to age 18 and to produce the net income throughout the working-period of life. At age 5, the corresponding figure is \$14,156 and at age 15, \$25,341. If we had assumed a higher rate of interest than three and a half per cent, the amounts would have been correspondingly smaller; at four and a half per cent, the value at birth would be one half as high. But in any case, the money value of children is no small matter. They represent, in a sense, the value of the social inheritance which comes to a human being because he is born in an economically organized state.

In the same manner, we computed the value of a man whose maximum earnings are \$5,000 a year. This represents a fairly large group of professional and small business men who have had better opportunities to advance themselves than their fellows. At age 18, the present worth of the net future earnings of a man in this group was found to be \$34,320. The actual maximum value occurs at age 32 when the net future earnings are worth \$49,100. The \$2,500 man reaches his maximum value seven years earlier at the age of 25, but his value as a producer is then \$17,000 less. The value of a child at birth in this group is \$9,629 and at the other ages of childhood the figures are only a little more than those I have quoted for the children in the \$2,500 income families. This is because of the much higher cost of bringing up a child in the higher income class.

It costs money to raise human beings to the point of self-support at least \$10,000, as we have seen. When they begin to work they produce a great deal more than they cost. We have calculated from the data which I have just presented to you—the value of males in the \$2,500 income class—what the sixty million male persons in the United States are worth. That is, we have computed, with regard to their present ages, the sum of their net future earnings. The aggregate figure is considerably over a thousand billion dollars. Unfortunately, we are not able to compute with the same exactness the economic value of the female population because the housewife's contribution to the family budget cannot be measured in dollars and cents. But, there are more than eight million gainfully occupied women in the United States, and those that are not gainfully employed have decided economic value to their families and to the State. If we estimate that the economic value of women in general is only one-half that of men, this will make the value of that sex 500 billions and the total vital assets, males and females combined, over

1,500 billion dollars. Our national wealth in material assets in 1922 was 321 billion dollars. This includes real property, live stock, machinery, agricultural and mining products, and manufactured goods of all sorts. Our vital capital, therefore, exceeded our ordinary material wealth about five to one.

II

This striking relationship between living capital, on the one hand, and material capital, on the other, is not limited to the United States, although it is possible that the difference between the two may not be as great as some other countries. Professor Nicholson, as far back as 1891, estimated that the living capital of the United Kingdom was five times that of all other capital. It would be a laborious task to determine the corresponding figure for England and Wales at the present time or to check up the figures for other nations. But, I should not be surprised if somewhat similar figures were obtainable in all civilized countries. For, even if human values, man for man, are economically lower in other lands than in our own because of lower per capita production and lower wages, the same relationship probably holds between live capital on the one hand and other forms of wealth on the other. In any case, we must see very clearly how great is the value of human life the world over. The figures I have quoted suggest how necessary it is to give due consideration to an effort to conserve this, the most valuable of our national resources.

With these figures as a background, we are now in a position to realize somewhat the losses which result annually from the interruptions due to illness and death. Our bodies are, after all, machines which need occasional overhauling. They wear out sooner or later, depending a good deal upon the care they receive. Sickness is one of the commonest of the facts of life and one of the most disturbing, as it interferes with production and breaks up normal family routine. It will be interesting to estimate the total economic loss sustained in this country on account of illness. Some years ago Doctor Frankel and I made a series of studies on the extent of sickness among a half million insured persons. The figures showed that about two per cent were constantly sick. Other observers, following similar methods, have confirmed our results, namely, that the average individual in the United States loses about seven days each year from sickness involving inability to work. There are additional days of discomfort which interfere more or less with a person's duties, but these were not included in the statistics. Converted into economic terms, this means that there is a loss of two per cent of total current production. This, in round numbers, amounts to more than a billion

and a quarter dollars annually in the United States. To this figure should be added the cost of such items as medical care, hospital service, drugs and appliances, and the like. To ascertain the extent of these expenditures we made an investigation of the cost of sickness among a group of people and found that the average annual expenditure was \$19 per capita for medical and nursing care and other items necessary in illness. This figure is probably higher than the average for the general population because the group studied had a rather favorable economic status. But, even if half this figure be used, say in round numbers \$10 per capita, the total cost of medical care, including all items, would amount to more than a billion dollars a year. We may, therefore, say with confidence that sickness costs directly in lost wages, in reduced production, as well as in the necessary care, a total of two and a quarter billion dollars a year.

Huge as these figures are, they do not cover the total which should be placed to the account of illness. In many instances sickness causes premature death, removing individuals in their prime when they have real and large economic values. Somehow, we must evaluate the total community losses which result from this item of premature death. I have calculated that about a third of the deaths which occur every year, even under the present conditions, are preventable. To be sure, the great bulk of such preventable deaths are in infancy and childhood. But I have shown you that even at these younger ages human beings have considerable monetary value. Every year 120 thousand babies die from altogether preventable conditions during the first year of their life. There is no reason for this slaughter except the ignorance of mothers and the indifference of the communities where they live. Possibly it might make a difference if our legislators realized that these babies have a capital value of more than \$9,000 if they are boys, and of \$4,600 if they are girls, and that the capital lost throughout the country from this preventable infant mortality reached the astounding figure of more than three-quarters of a billion dollars a year. If there are those who question my mathematics, I can still counter by recalling that there are enough preventable deaths of adult men and women which would make a real impression on economic production, to say nothing of the general happiness of the people of the United States. Every year more than 30,000 young men and women between 25 and 29 years of age die from entirely preventable causes, and their capital value, having in mind their net future earnings, is about three-quarters of a billion dollars. Having due regard for the value of life at each age period, I estimate that the total capital value of the lives which can be saved annually through the application of modern preventive medicine and public-health measures is over six billions of dollars. The losses, as you see, from sickness and

preventable death are enormous, as one might very well expect in view of the immense value of human life in the United States.

III

One would think under such conditions that no effort would be spared to conserve our living resources. But we have scratched only the surface of the possibilities in this direction. It would be quite unfair, however, to give the impression that nothing has been accomplished. The gains in extending human life and preventing sickness have been really considerable during the last half-century. There is already abounding evidence that the work of the public-health authorities to prevent illness and to conserve life, considered from a purely economic viewpoint, pays large dividends. Let us take the situation in a city like New York. The results are fairly typical of what has happened in other large centers of population. In 1875, the death rate was 28.3 per 1,000; in 1925, it was 11.5, or a reduction of 59.4 per cent. A better measure of the improvement is perhaps the gain in average duration of life. In 1880, the average life-span was about 40 years in New York City and most likely in other urban centers in the United States. It is now 55 or 56 years, a gain of about 15 years in less than a half-century. The greatest gains have been achieved recently. In 1901 a baby born in the U.S. Registration Area might expect to live 49.24 years; this expectation of life has now risen to 57.32 years. The present figures are not accidental but the result of a definite trend which has been fairly continuous for a whole generation, reflecting the work of a new force in the life of the people.

It will be interesting to examine the facts of the death rate for a number of the more important causes. The diseases which have been most reduced are those which affect infants and young children. In the last twenty years, the infant mortality rate has been cut 60 per cent. In the past one might almost have said that babies were born to die, for as many as one quarter of them did not survive the first year. To-day, in most American communities, only about 7 per cent die during that first difficult year and two-thirds of these deaths will be prevented in the near future. Not long ago typhoid fever was a common cause of sickness and death throughout the United States. Even as late as 1900 the death rate was 36 per 100,000 in the Registration Area. Epidemics raged in the large cities of the country because of polluted water supplies and because little was done to prevent the spread of the disease through secondary infection. But, with the installation of excellent water systems in the larger cities of the country, the typhoid-fever death rate dropped in an amazing manner. This disease is now not far from extinction,

certainly in the northern and urban sections of the country. The public-health campaign has been especially successful in the reduction of tuberculosis. In 1900, the death rate from this disease was 195 per 100,000. It is now less than one-half as high. More than 100,000 people are kept alive each year who under the old conditions would have succumbed to this disease alone. Diphtheria is another disease which the public health movement is on the point of wiping out completely. At the end of the last century this was one of the most important causes of death among children. When the first Registration figures became available in 1900, this disease had a death rate of 43.3 per 100,000; in 1923, this was reduced to 12.1, and it is rapidly dropping everywhere throughout the country. To-day we are considering seriously the possibility of the complete elimination of diphtheria by 1930 in such large areas as the State of New York. The more widespread application of known methods of prevention such as the general inoculation of children with toxin-antitoxin will completely conquer this scourge of childhood.

Possibly the most striking demonstration of the effectiveness of the modern health campaign is the experience of the Metropolitan Life Insurance Company with its millions of Industrial policy holders. Seventeen years ago, this organization instituted a program of health education and of nursing service for its working-class members. This business organization has expended altogether over twenty millions of dollars in this campaign. It has increased its annual budget for welfare work in response to an ever-increasing demand for service and also to the increasingly favorable results of the work done. For during this period the mortality rate has declined more than 30 per cent. and the accumulated saving in mortality between 1911 and 1925, which can be ascribed only to the welfare work of the Company, has totalled the amazing sum of 43 millions of dollars, or twice the total expended. During this period of the demonstration the death rate from tuberculosis among the Industrial policy holders has been reduced over 56 per cent; from typhoid fever, the reduction has been about 80 per cent; from the communicable diseases of childhood, the reduction was 55.5 per cent, and from diphtheria alone, the reduction was over 62 per cent since 1911. In every important condition the death rate has declined among the Industrial policy holders fully twice as fast as has occurred in the general population. As a result, the expectation of life of this group of workers and their families has increased by nine years during the interval, whereas the corresponding increase in the general population is about five years. Health work, when properly undertaken and adequately financed, pays by every test of a modern business organization.

IV

These achievements in the field of public health, both official and private, have completely changed the life of the average citizen in the modern State. People in our country, at least, no longer live in dread of the plague, of cholera, of yellow fever, of virulent smallpox, or of pernicious malaria, and a host of other specters. If they pass the rigors of childhood, they are generally able to round out a good expectation of years, to bring up their families, and otherwise to live a normal and happy life. Never, probably, in the history of the world has there been such widespread wellbeing for great masses of people. This is, I believe, in large measure, the response to the great improvement in health conditions which has occurred. Increased efficiency and huge productivity, uninterrupted by illness or preventable death, have ushered in many advantages which follow from a high level of economic wellbeing.

In spite of these achievements, there is still a large field to cultivate. Tuberculosis still causes a hundred thousand deaths annually and a loss of about two and a half years in the average expectation of life of the entire community. If this disease could be eliminated just that number of years would be added to the expectation of every member of society. Accidental deaths are becoming more frequent with the extension of the use of the automobile and the development of industry. The elimination of accidents would add more than a year to the average expectation of life. A goodly proportion of the deaths from heart disease, certainly those which occur at the younger ages, are preventable, and their prevention would add appreciably to the life span. And, thus in its entirety, if we were but willing to utilize the knowledge which we have of preventive medicine, in the life of the American people, we should raise the expectation of life from its present point of 57 or 58 years to close to 65. The discovery of a method to control cancer and a few other obscure diseases would further increase this expectation appreciably. But, even if we discount these future discoveries and limit ourselves to the application of such knowledge as we now have and which is only waiting to be applied, an average duration of life of 65 years is an entirely possible one for the American people. The people of New Zealand are very close to such an achievement at the present time. What they can do, we with our superior resources can do likewise.

We are confronted, therefore, with a very real situation. We know how great is the value of human life. We know also how great are the current losses from sickness and death. We have the knowledge and the necessary resources for the control of disease. Obviously, we must put our knowledge to work. That is the program of the public-health movement of the immediate future. To-day, public-health work is in its

infancy in spite of its achievements and the demonstration of its power. Most American communities still have political health administrations, inadequately financed, inadequately manned. Less than fifty cents per capita probably represents the total expenditure of the American people for public health. The money spent for medical service is almost altogether for the care of disease and not for its prevention. The relationship were better reversed. A new era of intensive public-health work must be brought about which will make available to the American people the power of this new branch of science. Expert opinion of public-health officials indicates that an expenditure of \$2.50 per capita wisely directed through organized channels against the preventable diseases and for public-health education would reduce the annual death rate two points per thousand and correspondingly increase the expectation from five to seven years. The money value of these added years of life as we have seen, runs into billions of dollars. There is no greater opportunity for a quick and more certain return on any investment than an investment in public health. The people of the United States and, in fact, of the whole world have not waked up to the enormous possibilities of profit in preserving life and health.

V

I am not unmindful of the fact that my subject is the economics of world health and that I have given very little consideration to other countries than the United States. This I have done because, as an American, I am most interest in the United States, and also because our country presents a rich detail of data not always present for other countries of the world. We can fortunately establish a basis for the development of an international viewpoint on health matters through the consideration of American conditions. There is, of course, a world-aspect to our problem, and I shall say a word with regard to that.

Much the same conditions exist to-day the world over, although countries vary somewhat with regard to the prevalence of disease, the expectation of life, and the economic value of their citizens. But, everywhere there is a great opportunity for the extension of health and for the prolongation of life and the increase of capital assets. It was in England that the modern public-health program took form and developed; and it is not surprising to find that among the English-speaking peoples the very best conditions of longevity and productivity occur. It is in far-away New Zealand that the longest average life time is found. The expectation of life at birth is more than 62 years in that country, and only a little less in Australia. The Scandinavian countries, Denmark, Norway, and Sweden, which very early applied the newer public-health procedures,

have conditions very much like those of the United States, perhaps even a shade better, namely, an average expectation at birth of about 58 years. England itself falls only slightly below these figures, with an average of about 55 years; France, Germany, Italy and Japan before the War had expectations varying from 45 to 48 years, or about ten years less than our own country. India stands at the very bottom of the list of the countries of the world, with an expectation of about 23 years.

These figures are the best basis of comparison we have for the well-being and prosperity of the nations of the world. Where life is long, debilitating sickness is less prevalent and economic production is highest. The extraordinary prosperity which has been witnessed in the United States is, in large measure, the result of the control which has been exercised over disease; of the freedom which men and women have attained to labor without interruption and without fear; the opportunity that our children have gained to grow up in the care of father and mother, amply supplied with the necessities of life and preserved from the trials and sorrows of broken families. Where, as in India, the duration of life is short, existence is surrounded by fear of death, and of crippling, and of invalidism. The capital spent in bringing up children is largely wasted because so few reach maturity to continue their full productivity for a period long enough to pay for themselves, with no thought of adding to the wealth of their country.

No greater service can be rendered to insure the general peace and prosperity than to improve the world's health. In this field of labor there are no international jealousies, but rather international obligations and opportunities. A low standard of health in any country is a menace to all its neighbors; in fact, to the whole world. It was because Europe and America were indifferent to the existence of influenza centers in Asia that this disease could later spread to all the world, causing more damage to life than the Great War. Prevention of disease and the prolongation of life for the people of India, for example, will bring prosperity to all the nations that have dealings with them; for the people of India will become better producers and, therefore, better customers for the products of the whole world. It is obviously, therefore, to the interest of the leading nations—those who have enjoyed greater advantages and opportunities in health work—to make available these advantages to those who are backward and to those who lack financial ability to institute progressive measures on their own account. The International Health Board, the Health Organization of the League of Nations, and those other bodies which function in international health service are at the very forefront in bringing nations together on a higher plane. Such work creates a better understanding between nations and increases mutual trust and respect. What concerns the health of the people touches after all the most responsive chord in the heart of mankind.

The Antisyphilitic Pharmacopoeia of Fracastorius

By THE HONOURABLE WILLIAM RENWICK RIDDELL, LL.D., D.C.L.,
President, Canadian Social Hygiene Council

(Having left untranslated many of the terms employed by Fracastorius,
I here collect and explain them.)

(Continued from April.)

Juncas Odoratus: *Andropogon Schoenanthus* or *bicornis* or *laniger* or *citratus*, &c., Sweet Rush, Camel's Hay or Straw (*Foenum* or *Stramen camelorum*), Squinanch—brought from India, Turkey, and Arabia. "It is a grateful aromatic of volatile and subtile parts". Quincy, p. 59—Often called *Schoenanthus* or *Juncus quadratus*.

Celsus, 5, 4 calls it *Juncus quadratus* (see the editor's note) an aperient: 5, 11, a discutient, &c.

Dios. 1, 16, *Odoratus Juncus* comes from Africa and Arabia, the best from Nabathaea, diuretic, emmenagogue, relieves pain in stomach, lungs, liver and kidneys, good for nausea, dropsy and inflammation of vulva.

Les. p. 88, under the name Squinant it is called Camels' Hay for they eat it greedily—styptic, diuretic, heals liver, matrix and kidneys and flux of blood.

Quincy, p. 59, and New Dispensatory, p. 144, make it a grateful aromatic (and probably that is all it ever was).

Juniper: *Juniperus communis*, Common Juniper, in America planted for ornament (generally the variety, *Juniperus Hibernica*).

Dios. 1, 87, calefaciant and astringent, good for pain in stomach and chest, coughs, serpent bites, a diuretic, ashes of the bark good for lepra, &c. Sandaraca was sometimes called *Lachryma Juniperi*—see *post*.

Laca: (Lacca): Lac deposited by insects on certain trees, formerly used as a tonic and astringent, Shellac, C., 7, 13.

Lachrymae panaceae:

Opoponax, q.v., *post*.

Lachrymae Myrrhae: *Myrrh*, q.v., Dios., 1, 67. *Myrrha lachryma est arboris lachrymae juniperi: Sandaraca*, q.v.

Lactuca: *Lactuca sativa*, Common Lettuce. Celsus, 2, 18 and elsewhere. Dios. 2, 129, antaphrodisiac, eyewash, &c.

Ladanum (Labdanum): Gum from the *Cistus Creticus*, *Cistus Ladani-ferus* or *Cistus Laurifolius*—we have the *Cistus Ladaniferus* in greenhouses as a showy flower: our *Cistaceae* are wild plants, Frost-weed, Pin-weed and *Hudsonia*.

Celsus, 3, 21, makes it diuretic: 6, 1, hair growing: and 6, 2 good for porrigo: 5, 19, 18 an ingredient in an exedent plaster. Dios. 1, 110, gives it the same qualities and says that it is gathered off the beards of goats feeding on the trees.

Les. p. 60, aromatic odor, digestive, heart-roborant.

Quincy, 66, it warms and dries, used chiefly externally.

Lapis Lazuli—the well known stone, a compound silicate containing sulphur, probably the ancient Sapphire, Dios. 5, 56, describes the *Coeruleus* which is apparently the same.

"It has astringent and moderately erodent power, produces crustae and ulcerates."

Lapathus: a generic name for the *Rumex* or Dock: it was sometimes used specifically for the *Rumex Acetosella*, Sheep Sorrel.

Larix—the Larch. Dios. 1, 77, gives its qualities.

Laricis lachrymae—Larch gum.

Laser, Laserpitium: a gum-resin obtained from the umbelliferous plant *Laserpitium* or *Silphium* (not our *Silphium* or Rosinplant). The *Laserpitium latifolium* is also called *Thapsia Laserpitii*. Many believed that *Asafoetida* came from the *Narthex asafoetida* and kindred umbellifers. Celsus, 3, 16 uses it to cure quartan fevers (his editor notes that is *Lac Cyreniacum*, *Opos Cyreniacos*, *Cyreniacum*, &c. &c.), Dios. 3, 76, gives a marvellous account of its virtues—tooth ache, old scabrous conditions of the throat, coughs, epilepsy, &c., all yield to it.

Les., p. 31, wrongly derives it from benzoin but says nothing of its qualities.

Laurinum (Oleum) Oil of Laurel, C. 2, 33 repressent and emollient. Dios. 1, 90, emollient, against serpent bites, lithontriptic, abortifacient and good for liver.

Les., 62, is unusually enthusiastic—the devil cannot touch this tree: "it has many great qualities for matrix and colon it cures hawks and all birds of prey and woman's burdens the stone of the bladder it breaks&c."

Lemnia Terra—*Sigillum Lemnium*, *Terra Sigillata*, *Sphragis*, *Sphragide*, *Lemnian Earth*: a reddish yellow, grey or white argillaceous earth brought from Lemnos: it is a kaolin and was thought to be the best of medicinal earth being used internally as an astringent, or

externally as an astringent and absorbent. Dios. 5, 63, mixes it with goat's blood, useful against poison internally and bites of animals, also for dysentery. Quincy, p. 97, identifies it with Armenian Bole, q.v. *supra*.

Lentes (sing. *Lens*) *Lens esculenta* or *Ervium Lens*, *Lentil*, Dios. 2, 101 makes it good for "bites of vipers, dogs and men."

Lentiscus: *Mastix*, *Mastich*, *Mastic*, q.v., *post*.

Lepusculi, young hares, *Lepus*.

Lichen: a generic term, including the Liverworts.

Ligustrum: the Privet, *Ligustrum vulgare*, (Linn.) Celsus, 2, 32, an emollient and repressant. Dios. 1, 107, for mouth ulcers, burning inflammations and carbuncles, headache and nerve sedative. Culpepper, p. 301, gives much the same and adds "to dry up fluxes". Quincy, p. 126, makes it a balsam.

Linum: *Flax Linum usitatissimum*. Celsus 2, 32, a warming cataplasm, &c. Dios. 1, 137, for poultices, also in mucilaginous drink for coughs, aphrodisiac, laxative and for inflammation of vulva.

Les., p. 37, has little to say of it.

Culpepper, p. 185, for poultices, &c.

Quincy, p. 104, gives praise to the mucilaginous drink made of the seeds for "defuxions of the rheum, catarrhs and tickling coughs . . . pleurisies, asthmas and many affections of the chest . . . also a laxative."

Lucernae: name given by Venetians to the *Cuculi*, q.v., *ante*.

Pliny, *Nat. Hist.* 9, 27, 43, tells of a fish in the high sea called *Lucerna*, whose fiery tongue, extruded from the mouth shines in quiet nights—it is mentioned again in the list, 32, 11, 53. The commentators can make nothing of it—they even cannot understand how a fish can extrude its tongue!

The name *Lucerne*, however, was once used in English for the Pike as was *Lupus*.

Lucii: the Pike Family, the ordinary pike being *Esox lucius*.

Luiula (*Lujula*): *Acetosa*, q.v., *ante*.

Lupinus: *Lupinus albus*, the white lupus cultivated in Europe as a pulse: Dios. 2, 102, diuretic, stomachic, tonic.

Lupus or **Lupulus**: *Humulus Lupulus*, the Hop. Pliny has *Lupus salictarius* in *Nat. Hist.*, 21, 15, 50.

Celsus 2, 15, 20—has *Lupus* a kind of fish identified by the commentator as the Perch, *Perca punctata* (or *fluviatilis*)—he does know the plant.

Culpepper, p. 206, opens liver and spleen, expels gravel, diuretic, "In cleansing the blood they help to cure the French disease and all manner of scabs, itch and other breakings out . . . tetters,

ringworm and spreading sores, the morphew and all discolorings of the skin"—vermifuge, emmenagogue.

Quincy, p. 109, "very discutient, aperitive and good in all obstructions of the viscera . . . *instead of hops, it is now common to use much cheaper bitters in brewing as, particularly, gentian, centaury, &c.*

Macir or Macer: Celsus knows nothing of it but Pliny says, *Nat. His.* 12, 8, 16, "Et macir ex India advehitur, cortex rubens radicia magna, nominis arboris suae: qualis sit ea incompertum habeo. Corticis melle decocti usus in medicina ad dysentericos precipuus habetur"—And Macir is brought from India, the red bark of a large root of a tree of that name—what kind of a tree it may be I have not found out. Great use is made in medicine in cases of dysentery of the bark boiled in honey. Galen: *de Fac. Simp. Med.*, Lib. vii, p. 205 and Aetius: *de Re. Med.*, Lib. i, p. 23 give the same account of it. Costa, the Portuguese physician who lived for a time at Goa, says: *Arom.*, c. 12, that the Portuguese call the tree, de las Caminas, *i.e.*, Dysentery tree, and the Brahmin physicians call it macre. He says that he saw it himself growing in Malabar and Cochin China. None of the Dictionaries in English, medical or otherwise, seem to know anything about Macir.

Dios. 1, 93, says that it comes "ex Barbaria" is and useful against dysentery and flux *per alvum*.

Majorana: Origanum Majorana, Sweet Marjoram. Dios. 3, 28 has origanum laxative, emmenagogue, cures ulcers of throat, mouth, nose, earache, &c. His editors say that his Thymum, 3, 35, is called by the French Majorana Anglica.

Les. p. 26, "Marjolaine, Sambssucus" is heating, purges dropsy "Pisser faict, lasche la vessie"—cures scorpion bites and is a heart stimulant, but this may be Dioscorides' sambucus, 4, 155, the dwarfelder.

Culpepper, p. 241, removes obstructions of spleen and liver, good for dropsy, diuretic, emmenagogue, if used as a pessary—cures earache and ear sounds, &c.

Quincy, p. 67, good against poison of some venomous creatures, catarrhs, &c.

Manna: a sweet yellow or whitish gum from the Fraxinus ornus: but it is also applied to hardened gum from several other trees.

Mastix: the gum of the Pistacia Lentiscus and other trees, Mastic, Mastich.

Celsus, 2, 33, repressent and emollient; 4, 20, 1, antihysterick; 4, 24, for tumors: 5, 6, caustic &c. Dios. 1, 75, for broken bones,

leucorrhoea, corroding ulcers, chronic cough, dysentery, bad breath and receding gums.

Les. p. 68, for coughs, diuretic, purulent ears, severe chest pains and "vient du pays grec".

Quincy, p. 133, good for plasters—coughs, pain in chest, detergent diuretic.

Mastichinum Oleum: Oil of Mastich.

Medulla Vituli: Calves' brain.

Melampodia: Helleborus niger (or officinalis), q.v., *ante*.

Melissa: Melissa officinalis, Balm, Bee Balm, Balm Mint, Balm Gentle: this and the following are not always distinguished: and cannot always be positively identified.

Melissophyllum (Melisphyllum or Melliphillum) Melittis Melissophyllum; called in Latin also Apiastrum, Bastard Balm. Pliny, *Nat. Hist.*, 20, 11, 45; 21, 29. Apiastrum is aster apium, bees' aster and was for the bees, 22, 41: 27, 109. The Melissophilum was most potent against stings of bees, wasps, spiders, scorpions—also for dogbites, dysentery, &c.

Dios. 3, 99 "Apiastrum, Melissophyllon or Melittaena" because bees delight in it, gives it the same qualities, adding scrofula and pains in the joints. The editors identify this with the official Melissa. Les. p. 69, Melisse "en grec Melissophilon, apiastrum par aultre verbe": leaves applied on the bite of a mad dog removes danger also in a serpent bite, emmenagogue, for tooth ache and pains in joints.

Charas, p. 165, has a fine Syrupus Melissae Compositus of 16 ingredients for a roborant, vermifuge, aperitive and stomachic.

Menae or Maenae a kind of small fish eaten salted by the poor. Pliny, *Nat. Hist.*, 9, 42, says they change color: 32, 9, 31, "Salted maenae with bull's gall applied to the umbilicus are laxative"—37, 104, they produce oil: 26, 11, and coloring dye; 32, 44, check phagedenic ulcers; 32, 46, cure warts and, 32, 28, and scrofula.

Dios. 1, 27 is not so fluent—ashes from their heads cure old anal fissures. The old Romans used the word as a term of contempt, our "poor fish": the modern Italian name is Medola: in French Bogue, Boga, Boops (*i.e.* Oxeye).

Menthae virides: Spearmint is properly Mentha viridis; but in the Poem, the plural may be used for the other mints. Dios. 3, 33, has a whole chapter on Mentha without differentiating any but Sylvestris which the Latins call Menthastrum. This is Calaminth, French Menthe sauvage. Pliny, *Nat. Hist.*, 19, 8, 47.

(To be continued)

Radio Talk

Prepared for the Canadian Social Hygiene Council and delivered at CKLC Broadcasting Studio, Toronto, January 4th, 1927.

THE EVOLUTION OF OUR PRESENT KNOWLEDGE OF DIPHTHERIA

By DR. CHAS. J. HASTINGS
Medical Officer of Health, Toronto.

THE Age preceding the birth of Christ, referred to in literature as "The Golden Age of Thought" was the age in which philosophy had almost reached its zenith. The age of philosophers, poets, artists, sculptors, statesmen. The age that gave to the world Socrates, Plato and Euclid, and that heard the thundering eloquence of Demosthenes and that saw the Olympian Zeus, fresh from the hands of Phidias.

It was this age that gave us Hippocrates, the Father of Medicine, whose writings and teachings constitute the foundation of the Science of Medicine of to-day.

Hippocrates was the first to set aside the traditions of ignorance and superstition. A Master of Clinical Medicine.

Many of the communicable diseases of to-day were known to Hippocrates, and in his writings as in the writings of other physicians of ancient times in Egypt, Palestine and Syria, one finds descriptions of a nose and throat pestilence which caused frightful suffering and death. This was no doubt Diphtheria.

Down through the centuries plagues of diphtheria spread over a good part of Europe and in the early part of the eighteenth century the whole of Europe was affected by diphtheria and serious outbreaks occurred in the early settlements of this continent.

Between 1850 and 1860 diphtheria epidemics were more or less constantly prevalent throughout the world and since then the disease has been intermittently present in practically every country.

Unfortunately, those engaged in the field of preventive medicine and public health were for centuries for the most part groping in the dark as regards this disease, until the immortal Pasteur, in 1864, revealed the fact that all these diseases were due to micro-organisms. It was then left for his colleagues and followers in the field of research to discover the specific germs that were responsible for the various communicable diseases.

The first victory over this dread disease was when the germ responsible for it was discovered in 1875 and subsequently obtained in pure cultures in 1882.

This organism was discovered by Klebs, and subsequently obtained in pure cultures by Loeffler. Hence it has been since known as the "Klebs-Loeffler" Bacillus.

Notwithstanding the fact that diphtheria is always local in its beginning, limited for the most part to the throat and nose, yet it subsequently becomes constitutional and affects, to a greater or lesser degree, every portion of the body.

This aroused suspicions on the part of the discoverers of the germ responsible for the diphtheria, and they made diligent search for this organism in samples of blood taken from those suffering from the disease, but failed to discover it. This work was pursued by Professor Emile Roux and his colleagues, in 1888 and 1890, when they were able to demonstrate that the toxin, a product of this germ, could be separated by filtration from the germ, and that this toxin, although it contained no germs, none the less, when injected into animals, produced the constitutional effects of the disease itself.

The next victory gained was in the discovery of Diphtheria Antitoxin in 1890. However, it was not until 1894 that Roux of France, a student of Pasteur's, at the Congress of Hygiene and Democracy in Budapest, spread the good news of the discovery of Diphtheria Antitoxin.

One can imagine the satisfaction of the immortal Pasteur in his declining days, having around him the whole scene of the making of this Antitoxin, which would be the means of the saving of millions of lives of children.

Before the discovery of Antitoxin and its use death claimed from 50 to 60 per cent. of those afflicted with diphtheria.

After the use of Antitoxin this mortality was reduced to from 7 to 10 per cent.

A most interesting feature about Antitoxin is that it is Nature's own remedy. A perfectly healthy, well-fed horse is gradually and painlessly immunized with small doses of Toxin, until its blood contains a large amount of Antitoxin. The brewing of this Antitoxin in the horse is Nature's own method.

A patient sick with diphtheria is doing exactly the same thing. He is brewing Antitoxin all the time, but unfortunately, the amount of Toxin is so great that in many cases the disease proves fatal before sufficient Antitoxin has developed. That is why the reinforcement of the human Antitoxin by that obtained from the horse explains the wonderful reduction in mortality after the use of Antitoxin.

However, it must be borne in mind that to obtain one hundred per cent. efficiency with Antitoxin, it must be given early and in large doses. If left until the third, fourth or fifth day, as is oft-times the case, the Antitoxin has little or no effect, the Toxin in the blood of the individual having done irreparable damage, which usually results in death.

And with this disease we have not only to consider the mortality, but also the sequelae, or the after-effects, of paralysis, a disabled crippled heart, probably for life, as well as organic diseases of the kidneys.

Notwithstanding the fact that we have been in possession of this wonderful therapeutic agent, Antitoxin, for thirty years, which, if administered early enough and in sufficiently large doses would mean the saving of at least 95 to 98 per cent. of all those suffering from this malady, yet year by year numbers of lives are being sacrificed.

In 1926 there were 87 deaths from diphtheria in Toronto, the vast majority of which were preventable.

Obviously then, Diphtheria is still one of the most deadly enemies of children, especially those under five years of age, as that age group constitutes from 50 to 75 per cent. of all deaths from this disease.

And this is the age at which parents or guardians are oft-times deceived by the insidious onset of the disease. They think the child has only an ordinary cold in the head, but this gradually grows worse, the doctor is at last called, but oft-times only after the child has become croupy, and breathing becomes painfully labored. It is then too late and even death itself is a happy release.

The last and final victory over this disease, and one which makes it possible for us to entirely exterminate the disease was the discovery of the Schick Test, a skin test by which it is possible to determine in any group of children, those that are susceptible to diphtheria, that is, those that would be likely to contract it if exposed to it, and those that are naturally immune, and next in order was the discovery of the immunizing solution "Toxoid" which is administered by two hypodermic injections of only 8 drops, a month apart.

This immunizing solution "Toxoid", when thus given, renders the patient absolutely immune to the disease in from 95 to 98 per cent. of the cases, and this immunity we know lasts for from 10 to 12 years, and probably for life.

The immunization against diphtheria has only been in use on this continent for approximately twelve years. None of those who were immunized twelve years ago have since developed a susceptibility to the disease. We have, therefore, every reason to believe that this immunity, thus rendered, is for life.

I would like to emphasize here that these injections of Toxoid are absolutely safe and harmless to small children. As a practical demonstration of this, in New York City, quite recently, over 2000 infants, 3 days

old, were given immunizing doses of the same strength as that given to an adult, without the slightest unpleasant after effects.

In the hundreds of thousands of cases where these protective injections have been given to children under six years of age, no unpleasant after effects have been noticed, other than would occur from the prick of a sterilized pin or needle, and in view of the fact that the vast majority of deaths occurring from diphtheria are in infants and children under five years of age, it must be obvious that the earlier Toxoid is administered after the first six months, the better.

Through this evolutionary process we are now in possession of a more complete knowledge of diphtheria, and have more absolute control of it than is the case of any other of the communicable diseases.

Through our knowledge of the germ that is responsible for the disease, we can detect the incipient cases and also the carriers.

We can also demonstrate by the Schick Test, or skin test, those that are susceptible and those that are immune.

We can produce a passive immunity by the use of Antitoxin and an active immunity by the use of Toxoid.

We are in possession of all the knowledge of all the haunts and habits of the organism we are fighting, and its toxic results, and also the ways and means by which all of our children can be absolutely and for all time protected against this disease.

Inasmuch as Medical Science has provided this safe and sure way of protecting our children against so dread a disease, and since the means of protection are so easily available, manufactured in our own University Connaught Laboratories, and provided free of charge by the Provincial Government through the Ministry of Health, no parent can afford to take the chances of having his child contract this disease.

It means not only a feeling of regret, but a certain sense of neglect and it is difficult to conceive of any experience more distressing than to have one's own child pass through the agonies of a severe attack of diphtheria, and probably pass away, and to realize that that was our responsibility. We have failed to measure up to the sacred trust that has been placed in our hands.

It is, therefore, imperative that without delay you have your family physician give your children this protection against diphtheria, or otherwise if you cannot afford a physician, take them to a public clinic at the Hospital for Sick Children, or in connection with the public schools and separate schools, where provision is being made by the Department of Health to administer this protection, free of cost.

We boast of our civilization, we boast of our freedom from slavery, but until we can shake from our feet the shackles of responsibility for this preventable disease, we are still under the bondage of the most unpardonable form of slavery.

The Sanitary Inspectors' Association of Canada

THE IMPROVEMENT OF HEALTH IN RURAL MUNICIPALITIES

By JOHN W. S. McCULLOUGH, M.D., D.P.H.,
Chief Officer of Health for Ontario.

(Read before the Annual Meeting at Brantford, Ont.)

PUBLIC Health means the prevention of disease and the conservation of life. Good health is the basis for the comfort, happiness and prosperity of a nation. There can be little comfort or happiness in the face of ill-health, and illness and loss of life make serious inroads upon individual and national prosperity.

The responsibility for the public health is shared in this country by various governments, dominion, provincial and municipal. It is also shared by the medical profession, and finally by the people themselves. The public health is every man's job and its results depend upon the thoroughness with which the job is prosecuted, and upon the intelligence and education of the public.

The government organization for public health both in the dominion and in the provinces is fairly satisfactory. It is good enough to produce results equal to those of any other country. It is by no means perfect, but in general there is improvement from year to year.

The municipal organization is well enough designed. It provides for a board of health, medical officer of health, sanitary inspectors, and the local board is empowered by law, in most of the provinces, to engage such services as may be necessary for local work.

In certain cities of Canada, a high standard of organization has been attained. The results of this organization are apparent in the supervision of the local water supplies, of milk and other foods, in the control of outbreaks of disease and the establishment of pre-natal, infant and tuberculosis clinics: there is close co-operation of the medical profession: health education is diffused among the people: and the work of medical and dental inspection of schools is in active operation. In certain of our cities the public health work done and the results achieved are not surpassed anywhere. These results are due to the fact that the public in these places have come to understand that health work pays, that in order to ensure its success, competent, well-paid officials are essential,

and that reasonable money must be spent. In every municipality in Canada where there is a full-time competent health officer, trained sanitary inspectors, nurses, etc., there will be found a community proud of its local health department and ready to back it financially and otherwise. When one comes to the smaller towns, the villages and the country townships, there is another story. The local board of health frequently exists on paper only. The medical officer of health is a practising physician in the neighborhood, giving a small portion of his time to health work. The sanitary inspector is a man of all work,—constable, truant officer, dog-catcher, etc. The water supply is often dangerous, raw milk is universally used, there are no pre-natal, tuberculosis or other clinics, and medical and dental inspection of school children, if in existence at all, is carried on by a nurse. The part-time practising physician naturally makes a poor health officer. With a few notable exceptions he is untrained for his work, and the very nature of public health work interferes with his practice. If he enforces the law in respect to contagious diseases, the people whom he places in quarantine, decline any longer to employ his services. He is bound to make enemies. His pay is too small to warrant his making sacrifices of the kind. There are, I am bound to say, a number of part-time health officers who give very valuable service to their communities. But they do the work at a personal loss. The health officer in a small town or in the country, is expected to keep down expenses, but keeping down expense is the surest way to fail in health work. If success is to be attained, money must be spent and in the end expense of the kind is justified by the objects attained.

I should say that the first requisite in the solution of the public health problem of the small town and country areas is *consolidation*. Health work is a financial problem with these places. The little town, the village, and the township are too small and too poor to afford a full-time health organization even if there were sufficient work in a single municipality for a body of the kind.

The townships, with their contained towns and villages should be grouped into areas comprising half or a whole county and a health organization set up for the entire community. Both in the United States and in England, a similar situation to ours is being solved in this way.

In the former country, within the last ten years upwards of 350 counties have appointed whole-time county health officers. In England there are some 400 "combined areas" each with a whole-time health officer. If the groups of municipalities in Canada were combined, they could jointly afford to spend say \$10,000 on an organization which within a few years would work wonders in rural health improvement.

A properly trained health officer for such an area, would be free from the cares of practice, he would, as an independent official, have the support and confidence of his colleagues. No more could the reflection be cast upon him that he favored his own clientele to the disadvantage of other persons. He would soon gain the support of the public.

But I am at once asked: What would a full-time health officer find to do in such an area? The properly trained officer will find more than he can do. He should be satisfied of the purity of the water supply for the entire area; seek out the early cases of tuberculosis; establish prenatal care for the mothers; supervise the health of the babies; be on the alert to check outbreaks of disease; inaugurate medical and dental inspection of schools, including physical examination of the children; and if he has any time left he could profitably devote it to the education of the public in health matters.

A medical officer of health alone will not be sufficient for the work in hand. He will need assistance. Every municipal unit of his territory will require a *trained* sanitary inspector. Unfortunately there are not yet at hand facilities for the training of such officers, but when the demand comes, these facilities will soon be forthcoming. He will need trained public health nurses to assist in school work, and he will need at least one veterinary surgeon to inspect the dairies and herds from which milk is obtained.

The expense of a full-time rural health organization of the kind has been shown to cost about \$10,000 a year. No money, judiciously spent, will afford so high a return on the investment.

There is no economy in rearing and educating children only to have them carried off by diphtheria or other contagious disease in early life. There is no economy in producing children crippled from humpback or hip-disease, due to the use of tuberculous milk, or of rickety children, who have been improperly fed. There is no economy in sending to school, children whose defects of sight, hearing or mentality only serve to retard their companions, and prevent themselves from gaining an education. School children who suffer from physical defects may profitably have those defects discovered and remedied by a proper system of school inspection. Much disease and illness result from defects of the teeth. Proper dental supervision of school children would eliminate 90% of the dental defects, show high improvement in the health of the children and greatly improve school discipline.

We are constantly recruiting the ranks of the tuberculous by failing to find at an early date the cases of this disease, and by the use of raw milk from tuberculous cattle. The use of milk itself is much neglected in the country. We forget that milk is the best food for children and that a want of milk lowers the stature as well as the mental and physical qualities of the individual.

A recent investigation made by the Medical Research Council of England among the 500 boys of a foundling school near London, showed that the addition of a pint of milk daily to a satisfying ration raised the annual weight of boys, 7 to 11 years of age, by 45%, and their height by 30%.

The most of country well-water is contaminated, because of the entrance of surface water run off to the wells. There is more typhoid in the country than in the city. Active supervision of a competent health organization would rapidly eliminate this disease. In the last 15 years the typhoid rate in the cities has dropped from 50.3 per 100,000 of population to 3.5, chiefly from supervision of water supplies and competent public health activity.

Flies, which carry a variety of diseases, abound in the country. The extermination of the fly is simple enough. Its attainment is a matter of education of the people to the dangers from flies. Screening of windows and doors, and frequent removal of horse manure and other filth from the neighborhood of the home is the remedy.

The housewife in the country bringing up a family, does so under difficult conditions. Insufficient rest, absence of proper medical supervision during pregnancy, improper food and lack of outdoor air and sunlight, combine to produce a delicate baby. Consequent upon enfeebled health, the mother is unable to nurse the infant. It is placed upon artificial food. Such an infant is handicapped from the start, and has a hard time running the gauntlet of the infections, of impure milk and lack of the attention from the overworked mother. The help of the public health nurse in such cases is invaluable. There is an annual loss of 15,000 babies in Canada, 34% of which die in the first week. At least one-half of this loss is preventable.

Measles, diphtheria, scarlet fever, and whooping-cough, still continue to cause an enormous amount of sickness in children. In 1924, there were 1,200 deaths and approximately 13,500 cases of diphtheria. There were 14,700 cases and 325 deaths from scarlet fever. Measles, diphtheria and scarlet fever may now be almost eliminated by the use of recent methods of prevention and treatment.

Someone has said that the doctors are on the wrong track, and that if they would only invent some preventive for disease, their fortune would be made. The fact is that within the memory of most of us, the doctors have invented more preventives and cures for disease than the public has been able to assimilate and use. Among these are: smallpox and typhoid vaccination, diphtheria antitoxin and toxoid for the immunization of cases, scarlet fever antitoxin, insulin and others. None of these beneficent inventions are used to anything like their full extent, simply because the public lacks a knowledge of their uses.

The highest death-rate we have is from organic heart disease. Apart from the venereal diseases the cause is rheumatism, acquired chiefly in childhood. Tonsillitis, growing pains, chorea, stiff neck, as well as the acute joint infections are largely of rheumatic origin and are potent causes of heart disease. The public should know that in the presence of such symptoms the child must have rest in bed until all manifestations of disease have passed. The rheumatic or heart case must have careful supervision if the ill effects of these conditions are to be avoided.

Cancer is increasing among all civilized nations. In the early stages it is readily curable. There is a tendency, chiefly in women, to minimize or conceal the early signs of this disease. A lump in the breast, bleeding from the internal parts, a sore which fails promptly to heal, are danger signals which should be heeded.

The most important work of the health officer is the education of the public in health. People should know the physiological basis for sound health habits, such as sleep, exercise, and the elimination of wastes, the proper foods to use, the principles of normal mental conditions, and the causes of degeneration. They should understand the sex instinct, how disease may be prevented, and be armed against the danger from polluted water, milk, soil and foods. They should appreciate the need for frequent medical and dental attention and be able wisely to select their medical and dental advisers. They should remember that modern medicine and disease prevention are founded on scientific discovery, and not on mystery, fancy and tradition, and they should be informed on important health problems and how to deal with them. Health, like thrift, is a habit that may be acquired.

Health education, widely disseminated, is one of the soundest means whereby disease can be controlled. The wisest government with the best of laws and regulations for health will fail of success in this direction in the absence of an intelligent public to appreciate and aid in the successful operation of the laws and rules of health.

In the health education of the public, a competent health organization finds its most important function.

Monthly Jottings of the Sanitary Inspectors' Association of Canada

The following quotations from a paper on "Public Health Propaganda from the viewpoint of the Sanitary Inspector", by Mr. W. E. Cooke, Chief Sanitary Inspector, Bingley, England, may be of interest.

"A growing field of opinion thinks that any further marked improvement in the nation's health will only be attained by securing the individual co-operation of the public. The individual must realize that he is now largely responsible for the safeguarding of his own health and that he must play the game of health for the sake of his community too."

"I do not for one moment suggest that public health propaganda will entirely obviate the need for ever exercising our compulsory powers. There will, I am afraid, always be some people who will not listen to reason and will require legal pressure before doing what may be their obvious duty. I am convinced, however, that the majority of the public will gladly shoulder their individual responsibilities if only the necessity for so doing is properly explained to them."

"The public will soon realize that the modern Health Officer is a person who has received considerable scientific training and possesses some technical ability; that he is to be regarded more as a guardian and teacher than a harsh official, and as a public servant who can readily be approached at any time for help or advice on any subject appertaining to sanitation."

"Many Inspectors hold back from educational work because they imagine they will of necessity be obliged to do an amount of public speaking, which they think is out of their line. At the same time, I do think that where an Inspector is asked to give a lecture on some branch of his work to the public, he should do so if at all possible."

"There yet remains another method of propaganda to be enumerated. For want of a better term I will call it the 'casual method'. We can all employ this every day in the course of our routine duties. It consists largely of the application of that great virtue, tact, which virtue every Sanitary Inspector should possess in plenty. I think it was Mr.

Moorehouse who told us a few years ago that Sanitary Inspectors were not privileged to ever lose their tempers. I agree. The patient explanation as to why we are taking a certain course of action will convince most people, and eventually win more respect for our profession and effect more lasting good than recourse to prosecutions at each and every opportunity."

We hope that our members are laying plans to be present at our Annual Convention in September.

Do not forget that any proposed amendments to the Constitution and By-laws must be in the hands of the Secretary 60 days before the Annual Meeting in order that a copy may be sent to every member.

At the May meeting of the Executive Council we had the pleasure of the presence of Mr. W. C. Millar, Vice-President for Ontario. Mr. Millar is hopeful that great advance may be made in Public Health work in that Province in the near future.

In view of the fact that our Convention is to be held in Toronto this year, we should like to see more of the Ontario Inspectors joining our Association so as to be able to attend and take part as members.

The Secretary, Mr. Alex. Officer, will be very glad to forward a copy of the Constitution and By-laws and an application form to any Sanitary Inspector desiring information. Address him at City Health Department, Winnipeg.

An examination of the Royal Sanitary Institute, Manitoba Branch, was held April 28th and 29th, at Winnipeg, when six candidates presented themselves. This indicates that a number of our young citizens are going the right way about it with a view to entering the Public Health service.

A number of Annual Subscriptions are still outstanding. Members who have neglected this matter will please take the hint.



The Provincial Department of Health of Ontario

Communicable Diseases Reported for the Province for the Weeks
Ending April 2nd, 9th, 15, 23th, 30th 1927.

COMPARATIVE TABLE

Diseases	April 1927		April 1926	
	Cases	Deaths	Cases	Deaths
Cerebro Spinal Meningitsi	4	1	2	0
Chancroid	0	0	2	0
Chicken Pox	623	0	395	0
Diphtheria	221	16	122	12
Encephalitis	1	0	1	1
Gonorrhoea	126	0	78	0
Influenza	60	24	0	164
German Measles	914	0	361	0
Measles	1346	2	1880	7
Mumps	183	0	158	0
Pneumonia	32	167	0	319
Poliomyelitis	0	0	0	0
Scarlet Fever	843	5	526	7
Septic Sore Throat	8	1	0	0
Small Pox	44	—	52	0
Syphilis	122	1	59	0
Tuberculosis	141	69	171	105
Typhoid	84	4	23	1
Whooping Cough	257	1	255	9
Goitre	5	2	0	0
Puerperal Septicaemia	0	1	0	0

The following municipalities reported cases of Small Pox:

Amabel Tp. 1, Orillia 3, Toronto 23, Weston 4, Belleville 3, Sidney
Tp. 2, Carleton Place 1, Ottawa 7.

News Notes

The thirteenth annual meeting of the Ontario Health Officers' Association will be held in Room 43, Physics Building, University of Toronto, June 13th and 14th.

On Wednesday, May 4th, a deputation from the Montreal Anti-Tuberculosis and General Health League waited upon the Executive Committee of the City Council to present a petition for an increased appropriation for the Montreal Department of Health.

The deputation was introduced by Dr. A. Grant Fleming. The petition was read by Doctor L. deLotbinière, Harwood, vice-chairman, and Sir Arthur Currie, chairman, spoke in support of it.

After some discussion, Alderman J. A. A. Brodeur, chairman of the Executive Committee, promised the delegation that an additional sum of \$50,000 per annum would be placed at the disposal of the Health Department.

This tangible evidence of the desire of the municipal authorities to improve health conditions by increasing the present very inadequate expenditure of 40 cents per capita is the most gratifying thing that has occurred in Montreal.

The generosity of Montreal citizens, as seen in the recent hospital campaign, is well known. If the municipal authorities become correspondingly alive to their responsibilities, we may hope to see Montreal soon attain its proper place in regard to health conditions.

The fifty-first Annual Session of the American Association for the Study of the Feeble-minded will be held in Cincinnati, Ohio, June 4, 5 and 6.

There has recently been prepared by the Department of Health of the Province of Nova Scotia a series of Regulations dealing with Tuberculosis control. These Regulations contain in the first place the different clauses taken from the Health Act which refer especially to that disease. To these have been added several new provisions, consistent with the general tenor of the Act, and intended to lend themselves to more efficient Tuberculosis control.

It was thought that the collection of all to form one Regulation would be of assistance to the local Boards of Health, the members of which might not have been able to acquaint themselves thoroughly with their powers and duties as laid down by Statute. These Regulations will be distributed as soon as they have been received from the printer.

The Annual Meeting of the Ontario Social Hygiene Council will be

held in Toronto, June 1st, under the chairmanship of Dr. D. V. Currey, St. Catharines. Dr. Grant Fleming, Managing-Director of the Montreal Anti-Tuberculosis and General Health League, will address the meeting.

The Annual Meeting of the Canadian Social Hygiene Council will be held in Toronto, June 13th.

Mayor Wilmot of Belleville, Ontario, is asking the Provincial Health Department to send an expert to the city for the purpose of making a thorough health survey and, particularly, examining the sources of milk supply.

This is not the result of any alarmist attitude regarding the city's health, but merely an effort to make certain that a repetition, in Belleville, of the unfortunate Montreal epidemic, be quite impossible.

In the current public health estimates, brought before the New Brunswick legislature, an appropriation of \$3,000 is provided, it was explained by Hon. Dr. Taylor, to provide an additional health officer for the counties of Restigouche, Madawaska and Gloucester.

An item of \$6,000 is included to carry on the present work of the venereal disease clinics. This is supplemented by a similar grant from the Federal government.

Hon. J. M. Uhrich, Minister of Public Health for Saskatchewan, recently made public the 1925 report of the Vital Statistics Division.

The birth rate, 24.7 per 1,000 of population, is again the second highest in the Dominion, New Brunswick alone exceeding it.

In marriages, Saskatchewan was low, ranking only sixth among the nine provinces with a rate of 5.9 per thousand.

Once more, however, Saskatchewan's death rate is not only the lowest in the Dominion but also in the world. For 1925, it was 6.8 per thousand.

In maternal mortality, at 5.2 per thousand living births, that province has the second lowest rate in the Dominion, but in infant mortality the rate is the second highest—81 per 1,000 living births. New Brunswick, singularly enough, has the highest infant death rate in Canada, namely 100.3.

During the year, there were 18 births for every death in the province.

The percentage of Canadian-born children has increased. The figures for 1925 show an increase, over the average for the preceding ten years, of one per cent. for Canadian-born fathers and four per cent. for Canadian-born mothers.

SIXTEENTH ANNUAL MEETING
CANADIAN PUBLIC HEALTH ASSOCIATION

Meeting conjointly with the Canadian Medical Association, Ontario
Medical Association and Canadian Tuberculosis Association

TORONTO, JUNE 14th, 15th, 16th, 1927

Preliminary Programme

All sessions will be held in Room 11, University College except
where otherwise noted

Luncheon Meeting

Tuesday, June 14th, 12.30 p.m.

"THE COUNTY HEALTH UNITS AS OPERATING IN THE PROVINCE OF QUEBEC"—
Dr. Alphonse Lessard, Director, Provincial Bureau of Health, Quebec.

Public Health Nursing Section

Tuesday, June 14th, 2.15 p.m., Room 11, University College.

Chairman, Miss Jean E. Browne.

(1) "THE TUBERCULOSIS HOSPITAL AND ITS FACILITIES FOR TEACHING PUBLIC
HEALTH NURSING."—Miss E. McPherson Dickson, Lady Superintendent, Toronto
Free Hospital, Weston.

Leader of Discussion, Miss Euna Kennedy, Montreal Anti-Tuberculosis and
General Health League.

(2) "THE CONTRIBUTION OF THE JUNIOR RED CROSS TO PUBLIC HEALTH"—Miss
Elsie Graves Benedict, Director Junior Section, League of Red Cross Societies,
Paris.

Leader of Discussion—Miss Florence Emory, President, Registered Nurses'
Association of Ontario.

(3) "HOUSING IN RELATION TO HEALTH"—Dr. R. St. John MacDonald, McGill
University.

Leader of Discussion—Dr. F. S. Burke, Director of Medical Services, Dept.
of Public Health, Toronto.

Tuesday, June 14th, 4.30 p.m. Meeting of the Executive Council of the Asso-
ciation—School of Hygiene Building, University of Toronto.

General Meeting of the Association**Tuesday, June 14th, 8.15 p.m. Physics Building.**

Chairman—Dr. George D. Porter.

"FOOD AND FOOD VALUES"—Prof. Andrew Hunter, University of Toronto.

The Honorary President, Hon. Dr. Forbes Godfrey, Minister of Health, Ontario, will confer Honorary Life Membership on:

Dr. M. M. Seymour, Deputy Minister of Health, Saskatchewan;

Dr. C. J. O. Hastings, Medical Officer of Health, Toronto.

Report of Honorary Secretary.

Report of Honorary Treasurer.

Report of Committees.

Public Health Nursing Section**Wednesday, June 15th, 9 a.m., Room 11, University College.**

Chairman—Miss Jean E. Browne.

(1) "RECENT DEVELOPMENTS IN THE FIELD OF PREVENTIVE MEDICINE AND THEIR NURSING IMPLICATIONS".—Miss Edith Hurley, Professor of Public Health Nursing, University of Montreal.

(2) "THE OBJECTIVE IN THE TRAINING OF PUBLIC HEALTH NURSES".—Miss E. Kathleen Russell, Director, Dept. of Public Health Nursing, University of Toronto.

(3) "THE PLACE OF THE PUBLIC HEALTH NURSE IN EPIDEMIOLOGY".—Mabel F. Gray, Asst. Prof. of Nursing, University of B.C.

(4) "EVALUATION OF PUBLIC HEALTH NURSING".—Dr. A. B. Chandler, Medical Director, Child Welfare Asscn., Montreal.

Joint Meeting with the Section of Preventive Medicine, Canadian Medical Association**Thursday, June 16th, 9 a.m., Room 11, University College.**

Chairman—Dr. George D. Porter.

"TYPES OF CLINICAL REACTIONS FOLLOWING THE INJECTION OF BIOLOGICAL PRODUCTS".—Dr. A. H. W. Caulfeild, Toronto.

"SOME ASPECTS OF PHYSIOLOGICAL HYGIENE".—Dr. C. H. Best, Toronto.

"NEWER DEVELOPMENTS IN THE CONTROL OF NARCOTIC DRUGS".—Dr. J. A. Amyot, Ottawa, Ont.

"IMMUNIZATION AGAINST DIPHTHERIA".—Dr. F. Adams, Windsor, Ont.

"THE MEDICAL AND LEGAL ASPECTS OF DRUG ADDICTION".—Dr. A. R. Richards, Burwash, Ont.

"PERIODIC HEALTH EXAMINATION".—Dr. A. Grant Fleming, Montreal, Que.

Laboratory Section**Wednesday, June 15th, 10 a.m., Pathological Building, University of Toronto.**

Demonstrations arranged jointly by the section of Pathology and Bacteriology, Canadian Medical Association and the Laboratory section of the Canadian Public Health Association.

Ontario Health Officers' Association

Physics Building, University of Toronto

Honorary President—The Honourable Dr. Forbes Godfrey.

President—Dr. T. W. G. McKay, M.O.H., Oshawa.

1st Vice-President—Dr. W. J. Cook, M.O.H., Sudbury.

2nd Vice-President—Prof. James Millar, Director, Branch Laboratory, Kingston, Ontario.

Secretary—M. Power, Department of Health, Ontario.

TENTATIVE PROGRAMME, THIRTEENTH ANNUAL MEETING, JUNE 13th AND 14th, 1927

MONDAY, JUNE 13th

10.30 a.m. Registration.

Moving Pictures.

FIRST SESSION

2.00 p.m. President's Address—Dr. T. W. G. McKay, M.O.H., Oshawa.

2.30 p.m. Address—Hon. Forbes Godfrey, Minister of Health.

2.45 p.m. "A Practical Health Unit for an Ontario Town"—Dr. B. J. Hazlewood, M.O.H., Bowmanville.

3.15 p.m. Discussion: Dr. G. H. Field, M.O.H., Cobourg.

Dr. H. H. Moore, M.O.H., Timmins.

3.45 p.m. "The Wage Earner's Health"—Dr. J. G. Cunningham, Director, Division of Industrial Hygiene.

SECOND SESSION

TUESDAY, JUNE 14th

10.00 a.m. Chairman—Prof. James Millar, Kingston.

"Tuberculosis and the Community"—Dr. T. W. G. McKay, M.O.H., Oshawa.

10.30 a.m. Discussion: Dr. A. S. McCaig, M.O.H., Sault Ste. Marie.

Dr. W. L. Hutton, M.O.H., Brantford.

Dr. J. H. Holbrook, Superintendent Mountain Sanatorium, Hamilton.

11.15 a.m. "Community Milk Supplies in Ontario"—Dr. D. V. Currey, M.O.H., St. Catharines.

Discussion: Dr. W. J. Cook, M.O.H., Sudbury.

Dr. A. E. Berry, Director of Division of Sanitary Engineering.

- 2.00 p.m. Chairman—Dr. T. W. G. McKay, M.O.H., Oshawa.
“Medical Care of Indigents”—Dr. W. E. George, D.O.H.,
North Bay.
- 2.45 p.m. Discussion: Dr. C. N. Laurie M.O.H., Port Arthur.
Dr. T. W. H. Young, M.O.H., Peterborough.
- 3.30 p.m. “The Specific Duty of the M.O.H. in Communicable
Disease”—Dr. James Roberts, M.O.H., Hamilton.
- 4.00 p.m. Discussion: Dr. A. L. McKay, Epidemiologist, Division of
of Preventable Diseases.
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Editorial

PURE MILK SUPPLIES

That any community or municipality in the Dominion may find itself facing exactly the same catastrophe that Montreal's health officials have been trying to cope with, unless thorough measures are undertaken to prevent it, is a state of affairs which should be unmistakably impressed on the mind of every Canadian.

Montreal, with the sources of its milk supply not effectively guarded against disease, fell a victim to a disastrous and prolonged epidemic of typhoid. Everything that medical science could do was helpless to prevent the outbreak running its course. It was possible to check it and to minimize the effects of the disease in its effect on individuals, but it was humanly impossible to stop it.

Comparisons may be odious, but, odious or not, in matters of public safety, they are highly valuable. There are a number of other Canadian cities where even a mild repetition of the Montreal disaster can never take place. Science has placed in the hands of health officers the means to make it impossible, and they have made use of it. Yet, in other cases, there is the peculiar spectacle of health officers being prevented, by the people whom they serve, from using the means at their disposal to forestall loss of life and terrific economic waste. True, ignorance and apathy are the usual reasons for the official's inability to act as he would like, and sometimes a false sense of economy on the part of a short-sighted group of civic officials, but the fact remains that this is the exact state of affairs in no small number of cases.

Preventive action is now under way in a number of centres. Dr. McCullough, Chief Medical Health Officer for Ontario, and Dr. Alexander White, Chief Sanitary Inspector, recently went to St. Catharines to confer with Dr. D. V. Currey on the situation there. At the present time, fifty to sixty per cent. of the milk supplied to the city is pasteurized. Dr. Currey is anxious to see that no milk is sold without this precaution, and that once legislative provision is made for this, the law shall be strictly and continuously enforced.

"If an epidemic could take place in Montreal, it could also take place in St. Catharines," he commented.

THE ONTARIO HEALTH OFFICERS

On June 13th and 14th, the Ontario Health Officers' Association meets in the Physics Building, University of Toronto.

As far as the medical profession is concerned, conventions are a matter of the most vital importance, and the progressive members of the profession are prompt to realize it. New discoveries and new advances in science are, at the present time, coming to light almost every few months. If the doctor is to keep pace with them, he must utilize every means of gaining additional knowledge, and there are few methods which are as effective in the distributing of fresh information as the convention.

Important as is the ordinary convention to the medical man carrying on a regular practice, the conference in question is doubly useful to the health officer. His field of endeavour is still a comparatively new one and he has scores of problems which do not affect other branches of the profession in the least. Conditions which he has to face are constantly changing, and it is a matter of the utmost necessity for him to equip himself to meet them. To do so and to keep up with the most recent developments in his work, it is essential for him to be in touch with as many other health officers as possible. No other aid can assist him in his duties as effectively as the knowledge he can gain from the experience of other men.

In the case of the Ontario convention, everything possible has been done to make it easy for the individual health officer to attend. His municipality is required by law to send him and to provide funds to cover his expenses. The question of his participation in the proceedings rests almost entirely with the individual. In his own interest, it is unlikely that any health officer who finds it at all possible to attend, will be absent.

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